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VAN DYKE, GARDNER, LINN & BURKHART, LLP
SUITE 207
2851 CHARLEVOIX DRIVE, S.E.
GRAND RAPIDS, MI 49546

EXAMINER	
ROBERTS, JESSICA M	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/822,476	ANTONIS, JAN	
	Examiner	**Art Unit**	
	JESSICA ROBERTS	2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _23 December 2008_.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-14,16 and 17_ is/are pending in the application.

4a) Of the above claim(s) _15_ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-14,16 and 17_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Status of Claims (11/98060) official notice

Claims 1-14 and 16-17 are currently pending. Claims 16-17 have been added, and claim 15 has been cancelled by Applicant's amendment filed on 12/23/2008.

Response to Arguments

Applicant's arguments with respect to claim 12/23/2008 have been considered but are moot in view of the new ground(s) of rejection.

1. As to Applicant's argument with respect to claim 1, that Bachelder does not disclose projecting image edge data components onto the object plane to produce a respective object edge data component.

2. The Examiner respectfully disagrees. It appears that the Applicant is attacking the references individually. The combination of Kosuge and Bachelder teach the claimed limitation. As disclosed by the applicant (page 2 line 1-4) the object plane is, in use, the object to be inspected is located. Kosuge discloses an x-y stage which the object is located, fig. 1 elements 2 (object) and 6 (x-y stage). Bachelder discloses where in one aspect, a method of determining a characteristic (such as position, orientation, size, center of mass, or boundary) of an object in an image. The method includes finding points in the image on the boundary of the object. The method further includes identifying bounding boxes or regions, in the image that correspond to edges of the object. For a rectilinear object, for example, this includes a bounding box for each of the top, bottom, left, and right edges of the object. The boundary points are labeled to denote the respective edges which they belong based on (i) locations and orientations

of those points, and (ii) locations of the plural bounding points. In a related aspect, the invention provides a method as described above, in which points apparently lying on a boundary of the object, but outside a bounding box, are ignored-- and, more particularly, are denoted as not corresponding to an edge, column 2 line 15-34., and fig. Therefore, it is clear to the Examiner that Kosuge modified by Bachelder discloses for an object located on a stage, to determine the edge of the object, which reads upon the claimed limitation.

3. As to Applicant's argument regarding neither Kosuge nor Bachelder discloses the following features of claim 1: *the processing apparatus being arranged to project each image edge data component onto the object plane to produce a respective object edge data component in the object plane.*

4. The Examiner respectfully disagrees. See the response to the argument above.

5. As to Applicant's argument regarding for the same reasons given in relation to claim 1, adjusting the field of view of the camera, or moving the camera or the stage, cannot replicate the adjustment of object edge data components required by claims 2 to 4.

6. The Examiner respectfully disagrees. Kosuge, the XY stage moves the inspection object into a view of field of the optical microscope, col. 8 line 62-64. Furthermore, by moving the either the camera or the stage, it would allow for the object to be positioned a field of view of the camera).

7. As to Applicant’s argument the specific amount of the adjustments given in claim 2 to 4 are not disclosed or suggested by Kosuge.

8. The Examiner respectfully disagrees.

9. As to Applicants argument regarding Bachelder does not disclose an object plane.

10. The Examiner respectfully disagrees. It appears that the Applicant is attacking the references individually. The combination of Kosuge and Bachelder teach the claimed limitation. As disclosed by the applicant (page 2 line 1-4) the object plane is, in use, the object to be inspected is located. Kosuge discloses an x-y stage which the object is located, fig. 1 elements 2 (object) and 6 (x-y stage). Bachelder discloses where in one aspect, a method of determining a characteristic (such as position, orientation, size, center of mass, or boundary) of an object in an image. The method includes finding points in the image on the boundary of the object. The method further includes identifying bounding boxes or regions, in the image that correspond to edges of the object. For a rectilinear object, for example, this includes a bounding box for each of the top, bottom, left, and right edges of the object. The boundary points are labeled to denote the respective edges which they belong based on (i) locations and orientations of those points, and (ii) locations of the plural bounding points. In a related aspect, the invention provides a method as described above, in which points apparently lying on a boundary of the object, but outside a bounding box, are ignored-- and, more particularly, are denoted as not corresponding to an edge, column 2 line 15-34., and fig. Therefore, it is clear to the Examiner that Kosuge modified by Bachelder discloses for an object located on a stage, to determine the edge of the object, which reads upon the claimed limitation.

11. As to Applicant's argument that that Bachelder does not discloses the processing apparatus determines whether each object edge data component relates to an edge of the object that lies on the work surface or to an edge of the object that is spaced apart from the work surface.

12. The Examiner respectfully disagrees. The Examiner respectfully disagrees. It appears that the Applicant is attacking the references individually. The combination of Kosuge and Bachelder teach the claimed limitation. As disclosed by the applicant (page 2 line 1-4) the object plane is, in use, the object to be inspected is located. Kosuge discloses an x-y stage which the object is located, fig. 1 elements 2 (object) and 6 (x-y stage). Bachelder discloses where in one aspect, a method of determining a characteristic (such as position, orientation, size, center of mass, or boundary) of an object in an image. The method includes finding points in the image on the boundary of the object. The method further includes identifying bounding boxes or regions, in the image that correspond to edges of the object. For a rectilinear object, for example, this includes a bounding box for each of the top, bottom, left, and right edges of the object. The boundary points are labeled to denote the respective edges which they belong based on (i) locations and orientations of those points, and (ii) locations of the plural bounding points. In a related aspect, the invention provides a method as described above, in which points apparently lying on a boundary of the object, but outside a bounding box, are ignored-- and, more particularly, are denoted as not corresponding to an edge, column 2 line 15-34. Further disclosed, in still further related aspects of the invention, the method ignores apparent boundary points that lie within a bounding box

and at the expected angle, yet reside too far from a line connecting points associated with the same edge. For example, the method can fit a line (e.g., using a least squares technique) to image points that apparently correspond to the top edge of a rectilinear object, i.e., points that lie within the bounding box corresponding to that edge and that lie at the angle associated with that edge (0.degree. or 180.degree.) with respect to the coarse estimate of the position of the object in the image. Any of those points lying more than a specified distance, e.g., three standard deviations, from the edge are ignored. Therefore, it is clear to the Examiner that Kosuge modified by Bachelder discloses for an object located on a stage, to determine the object edge of an object, and whether the edge is located apart from the object, which reads upon the claimed limitation.

13. As to Applicant’s argument that Bachelder is not concerned with creating three dimensional object data from the two dimensional capture image data and does not disclose determining whether or not an object edge data component relates to an edge of the object that lies on the work surface or to an edge of the object that is spaced apart from the work surface.

14. The Examiner respectfully disagrees. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

The combination of Kosuge (modified by Bachelder and AAPA) meets the claimed limitation. In this case, AAPA discloses where alternatively some systems

employ specialized optical equipment such as a telecentric lens or a line scan camera, to constrain the system so that 3D measurement data can be resolved from a single image [0005]. Since measurement is synonymous with dimensions and dimension is one of three coordinates determining a position in space or four coordinates determining a position space and time and AAPA discloses to perform 3D measurements form a single image, it is clear to the examiner that the 3D measurement data obtained would be fully capable of identifying image data components that represent the position of the object, which reads upon the claimed limitation.

15. Therefore, it would have been obvious to one of ordinary skill in the art the time of the invention to incorporate the teachings of AAPA with Kosuge (modified by Bachelder) for allowing more efficient image analysis.

16. As to Applicant's argument that Bachelder does not disclose any of the following features of Claim 5: calculating a respective first parameter relating to a notional reference line extending from the object edge data component, calculating a second parameter relating to a notional line extending between the object data component and a reference point in the object plane, and comparing the difference between said first parameter and said second parameter against a threshold value, not least because, as described above, Bachelder does not disclose object data components, or an object plane since the "object" as disclosed by Bachelder is an object within an image and not an object that lies on a work surface.

17. The Examiner respectfully disagrees. Bachelder discloses in further accord with this embodiment of the invention, once the boundary points 150 have been associated

with edges, 102 A-102D of the model, the method can use optional steps 48-50 to identify and discard categorized boundary points that are out of line with similarly situated points, column 9 line 51-56. Since Bachelder discloses the method can use optional steps to determine and discard boundary points outside of similar situated points, it is clear to the examiner that Bachelder would be more than fully capable of performing optional steps for determining the locations of the object edge data, which reads upon the claimed limitation.

18. As to Applicant's argument regarding that the teaching of Bachelder either on its own or in combination with Kosuge and/or the AAPA do not disclose or suggest the combination called for in claim 5.

19. The Examiner respectfully disagrees. See the response above.

20. As to Applicants argument that Bachelder makes no disclosure of the notional reference lines, first and second parameters, and threshold values comparisons of claim 5 (not least because there are defined in terms of object edge data components and the object plane neither of which are disclosed by Bachelder), or the more specific definition of the first parameter given in claim 6.

21. The Examiner respectfully disagrees. Bachelder, col. 8 line 32-46 and fig. **3E** Bachelder discloses a method that categorizes boundary points of the object in the image as corresponding with edges of the real world object, or its model, if those points lie in the corresponding bounding boxes. In accord with steps **42, 46** the method identifies points as residing in bounding boxes and therefore corresponds to the appropriate edge

22. As to Applicant's argument that claim 7 depends from claim 1, and claim 8 depends from amended claim 5 and ultimately from amended claim 1; claims 7 and 8 are therefore patentably distinguishable over Kosuge, Bachelder, and Buckley for at least the reasons set forth above.

23. The Examiner respectfully disagrees. See discussion for above for claim 1 and claim 5.

24. As to Applicant's argument regarding claims 9 and 10 depend from amended claim 1 and are therefore patentable distinguishable over Kosuge, Bachelder, and the AAPA for at least the reasons set forth above. Moreover, the respective features of these claims are not disclosed anywhere in Kosuge, Bachelder, or the AAPA.

25. The Examiner respectfully disagrees. See the response above for claim 1.

Acknowledgment of Amendments

Applicant's amendment filed on 12/23/2008 overcomes the following objection(s)/rejection(s):

The objection to the specification has been withdrawn in view of Applicant's amendment.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. Claims 1-8, 12-13, and 14-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kosuge et al., US-6, 571, 196 in view of Bachelder et al., US-5, 974, 169 in view of Applicant Admitted Prior Art (AAPA), and in view of Buckley et al. US-6,064,759 and further in view of Well Know Prior Art (Official Notice).

Regarding **claim 1** Kosuge discloses a work surface providing an object plane on which, in use, the object to be inspected is located (XY stage; col. 4 line 14 and **6**); and a camera having a focal point and a field of vision arranged with respect to the work surface so that at least part of the work surface is within the camera's field of vision (video camera; col. 1 line 16-19 and **3.** Further, it is clear to the examiner that the video camera includes a focal point and field of view), the camera being arranged to capture an image of the object (fig. 2), the image comprising a plurality of image data components (pixels; col. 3 line 39), the system further including an apparatus for processing the object image (processor; col. 4 line 12 and **4**), the apparatus being arranged to receive image data components from the camera and to identify a plurality of said image data components that represent the position of a respective edge component of the object in an image plane, wherein, during the capture of image by the

camera, the camera and the object are fixed with respect to one another (Kosuge; fig. 1), the processing apparatus is arranged to adjust he value of the offset in a direction generally perpendicular with the work surface to the perpendicular distance of the camera's focal point form the object plane (Kosuge; XY stage moves the inspection object into a view field of the optical microscope, col. 8 line 62-64. The examiner takes the position that, upon determining that an object edge data component is above the work surface, to adjust the value of the object edge data component by an amount depending on the ratio of the size of the offset in a direction generally perpendicular with the work surface to the perpendicular distance of the camera's focal point from the object plane is nothing more that adjusting the field of view for the camera. Also, the examiner takes the position that the offset is when the object is not located in the field of view of the camera, which would include being offset in the x, y, and z plane),

Kosuge is silent in regards to the processing apparatus being further arranged to determine whether each object edge data component relates to a lower edge of the object that lies on the work surface or to an upper edge of the object that is offset above the work surface by an amount substantially equal to a thickness of the object at said upper edge, and processing apparatus being arranged to project each image edge data component onto the object plane to produce a respective object edge data component in the object plane.

However, Bachelder teaches the processing apparatus being further arranged to determine whether each object edge data component relates to an lower edge of the object that lies on the work surface or to an upper edge of the object that is offset above

the work surface (Bachelder discloses where in one aspect, a method of determining a characteristic (such as position, orientation, size, center of mass, or boundary) of an object in an image. The method includes finding points in the image on the boundary of the object. The method further includes identifying bounding boxes or regions, in the image that correspond to edges of the object. For a rectilinear object, for example, this includes a bounding box for each of the top, bottom, left, and right edges of the object. The boundary points are labeled to denote the respective edges which they belong based on (i) locations and orientations of those points, and (ii) locations of the plural bounding points. In a related aspect, the invention provides a method as described above, in which points apparently lying on a boundary of the object, but outside a bounding box, are ignored-- and, more particularly, are denoted as not corresponding to an edge, column 2 line 15-34. Since Bachelder discloses for a rectilinear object, for example, this includes a bounding box for each of the top, bottom, left, and right edges of the object. The boundary points are labeled to denote the respective edges which they belong based on (i) locations and orientations of those points, and (ii) locations of the plural bounding points, it is clear to the Examiner that Bachelder discloses determining the upper and lower edges of the object, which reads upon the claimed libation); and processing apparatus being arranged to project each image edge data component onto the object plane to produce a respective object edge data component in the object plane (the boundary points in the image are labeled to denote the respective edges to which they belong based on the locations and orientations of those points, and locations of the plural bounding boxes, col. 2 line 26-29).

Therefore, it would have been obvious to one of ordinary skill in the art to modify the apparatus of Kosuge with the technique as disclosed in Bachelder in order to provide improved machine vision methods and, particularly, improved methods for determining characteristics of an object in an image.

Kosuge (modified by Bachelder) is silent in regards to the work surface by an amount substantially equal to a thickness of the object at said upper edge, such that said object edge data components that are determined to relate to an upper edge of the object are adjustable with respect to the other data components produced by said processing apparatus from said single image.

However,

The combination of Kosuge and Bachelder as a whole are silent in regards to a single image; apparatus being arranged to receive image data components from a single image of the object from the camera and to generate, using said image data components of said single image, three dimensional data representing a least part of the object, and wherein in order to generate said three dimensional data the apparatus is arranged to identify a plurality of said image data components that represent the position of a respective edge component of the object in an image plane.

However, AAPA discloses where alternatively some systems employ specialized optical equipment such as a telecentric lens or a line scan camera, to constrain the system so that 3D measurement data can be resolved from a single image [0005]. Since measurement is synonymous with dimensions and dimension is one of three coordinates determining a position in space or four coordinates determining a position

space and time and AAPA discloses to perform 3D measurements form a single image, it is clear to the examiner that the 3D measurement data obtained would be fully capable of identifying image data components that represent the position of the object, which reads upon the claimed limitation.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teachings of AAPA with Kosuge (modified by Bachelder) for allowing for more efficient image analysis.

Kosuge (modified by Bachelder and AAPA) is silent in regards to the processing apparatus is arranged to adjust the value of the respective object edge data component ;such that said object edge data components that are determined to relate to an upper edge of the object are adjustable with respect to the other data components.

Buckley discloses where in the procedure above, errors in components and assembly of inspecting system 40 are systematically matched with those of the geometric model. Error tables (LUTs) are used that adjust the actual measurements to the geometric model or parameters are determined that adjust the geometric model to the actual measurements. The result is an accurate prediction by the geometric model of surface and edge locations of objects 44 that are subsequently inspected by system 40, column 28 line 25-30. Therefore, it is clear to the Examiner that Buckley discloses to adjust the actual measurements where the edge locations of the objects are inspected which reads upon the claimed limitation. Incorporating the teaching of Bachelder, where disclosed is determining an upper edge (column 2 line 15-34) with the teaching of

Buckley to adjust the actual measurements where the edge locations of the objects are inspected, the limitations of claim 1 are met.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teachings of Buckley with Kosuge (modified by Bachelder and AAPA) in order to optimize the inspection process in order to increase the speed and improve the accuracy of the inspection.

Kosuge (modified by Bachelder, AAPA and Buckley) is silent in regards to an offset above the work surface by an amount substantially equal to a thickness of the object at said upper edge.

However, Official Notice is taken that both the concept and advantage of providing the limitations as claimed are notoriously well known and expected in the art, and therefore, would have been obvious to incorporate in Kosuge (modified by Bachelder, AAPA, and Buckley) for providing efficient image processing.

Regarding **claim 2**, Kosuge (modified by Bachelder, AAPA, Buckley, and Well Known Prior Art) as a whole teaches everything as claimed above, see claim 1. In addition, Kosuge further teaches wherein when an edge profile of the object taken in a plane generally perpendicular to the object plane is generally perpendicular to the object plane, or is undercut, said object edge data adjusted by subtracting an amount substantially equal to said ratio multiplied by the relative distance between the object edge data component and the position of the camera's focal point in the object plane (Kosuge, the XY stage moves the inspection object into a view of field of the optical microscope, col. 8 line 62-64. Furthermore, by moving the either the camera or the

stage, it would allow for the object to be positioned a field of view of the camera). Bachelder is silent in regards to <u>determined to relate to an upper edge of the object.</u>

However, Bachelder <u>determined to relate to an upper edge of the object </u>column 2 line 15-34).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teachings of Bachelder with Bachelder (modified by AAPA, Buckley, and Well Known Prior Art) in order to provide improved machine vision methods and , particularly, improved methods for determining characteristics of an object in an image.

Regarding **claim 3**, Kosuge (modified by Bachelder, AAPA, Buckley, and Well Known Prior Art) as a whole teaches everything as claimed above, see claim 1. In addition, Kosuge teaches the processing apparatus is arranged to determine if the angle of the beveled edge profile is greater than the angle made by a line of sight from the camera's focal point to said object edge data component and, upon so determining, to adjust said object edge data component<u>s that are determined to relate to an upper edge of the object</u> by subtracting an amount substantially equal to said ratio multiplied by the relative distance between the object edge data component and the position of the camera's focal point in the object plane and by adding an amount substantially equal to the distance in the object plane between the edges of the beveled profile along said line of sight (Kosuge, the XY stage moves the inspection object into a view of field of the optical microscope, col. 8 line 62-64. Furthermore, by moving the either the camera or the stage, it would allow for the object to be positioned a field of view of the camera).

Kosuge is silent in regards to wherein when an edge profile of the object taken in a plane generally perpendicular to the object plane is beveled, and the object edge data points are determined to relate to an upper edge of the object.

However, Bachelder teaches wherein when an edge profile of the object taken in a plane generally perpendicular to the object plane is beveled (Bachelder, determining the characteristics of the object of any polygon shape; col. 4 line 64-66), and the object edge data points are determined to relate to an upper edge (column 2 line 15-34).

Therefore, it would have been obvious to one of ordinary skill in the art to modify the apparatus of Kosuge (modified by AAPA, Buckley, and Well Known Prior Art) with the technique as disclosed in Bachelder in order to provide improved machine vision methods and, particularly, improved methods for determining characteristics of an object in an image.

Regarding **claim 4**, Kosuge (modified by Bachelder, AAPA, Buckley, and Well Known Prior Art) as a whole teaches everything as claimed above, see claim 1. In addition, Kosuge teaches the processing apparatus determines that an object edge data component relates to edge of the object that lies on the work surface, the processing apparatus is arranged to determine if the angle of the undercut edge profile is greater than the angle made by a line of sight from the camera's focal point to said object edge data component and, upon so determining, to adjust said object edge data component by an amount substantially equal to the distance in the object plane between the edges of the undercut profile along said line of sight (Kosuge, the XY stage moves the inspection object into a view of field of the optical microscope, col. 8 line 62-64.

Furthermore, by moving the either the camera or the stage, it would allow for the object to be positioned a field of view of the camera). Kosuge is silent in regards to an edge profile of the object taken in a plane generally perpendicular to the object plane; object edge data component relates to a lower edged of the object that lies on the work surface.

However, Bachelder teaches an edge profile of the object taken in a plane generally perpendicular to the object plane is undercut (Bachelder, determining the characteristics of the object of any polygon shape; col. 4 line 64-66) object edge data component relates to a lower edged of the object that lies on the work surface (Bachelder discloses where in one aspect, a method of determining a characteristic (such as position, orientation, size, center of mass, or boundary) of an object in an image. The method includes finding points in the image on the boundary of the object. The method further includes identifying bounding boxes or regions, in the image that correspond to edges of the object. For a rectilinear object, for example, this includes a bounding box for each of the top, bottom, left, and right edges of the object. The boundary points are labeled to denote the respective edges which they belong based on (i) locations and orientations of those points, and (ii) locations of the plural bounding points. In a related aspect, the invention provides a method as described above, in which points apparently lying on a boundary of the object, but outside a bounding box, are ignored-- and, more particularly, are denoted as not corresponding to an edge, column 2 line 15-34. Further disclosed, in still further related aspects of the invention, the method ignores apparent boundary points that lie within a bounding box and at the

expected angle, yet reside too far from a line connecting points associated with the same edge. For example, the method can fit a line (e.g., using a least squares technique) to image points that apparently correspond to the top edge of a rectilinear object, i.e., points that lie within the bounding box corresponding to that edge and that lie at the angle associated with that edge (0.degree. or 180.degree.) with respect to the coarse estimate of the position of the object in the image. Any of those points lying more than a specified distance, e.g., three standard deviations, from the edge are ignored. Therefore, it is clear to the Examiner that Bachelder discloses for an object located on a stage, to determine the object edge of an object, and whether the edge is located apart from the object, which reads upon the claimed limitation.

Therefore, it would have been obvious to one of ordinary skill in the art to modify the apparatus of Kosuge (modified by AAPA ,Buckley, and Well Known Prior Art) with the technique as disclosed in Bachelder in order to provide improved machine vision methods and, particularly, improved methods for determining characteristics of an object in an image.

Regarding **claim 5** Kosuge (modified by Bachelder, AAPA, Buckley, and Well Known Prior Art) as a whole teaches everything as claimed above, see claim 1. Kosuge is silent in regards to, the processing apparatus is arranged to determine whether said object edge data components relate to a lower edge of the object that lies on the work surface or to an upper edge of the object calculating a respective first parameter relating to a notional reference line extending from the respective object edge data component, calculating a second parameter relating to a notional line extending between the

respective object edge data component and a reference point in the object plane, and comparing the difference between said first parameter and said second parameter against a threshold value.

However, Bachelder teaches the processing apparatus is arranged to determine whether said object edge data components relates to a lower edge of the object that lies on the work surface or to an upper edge of the object that is offset above the work surface by an amount substantially equal to a thickness of the object at said upper edge by calculating a respective first parameter relating to a notional reference line extending from the respective object edge data component, calculating a second parameter relating to a notional line extending between the respective object edge data component and a reference point in the object plane, and comparing the difference between said first parameter and said second parameter against a threshold value (Bachelder; Bachelder discloses where in one aspect, a method of determining a characteristic (such as position, orientation, size, center of mass, or boundary) of an object in an image. The method includes finding points in the image on the boundary of the object. The method further includes identifying bounding boxes or regions, in the image that correspond to edges of the object. For a rectilinear object, for example, this includes a bounding box for each of the top, bottom, left, and right edges of the object. The boundary points are labeled to denote the respective edges which they belong based on (i) locations and orientations of those points, and (ii) locations of the plural bounding points. In a related aspect, the invention provides a method as described above, in which points apparently lying on a boundary of the object, but outside a bounding box,

are ignored-- and, more particularly, are denoted as not corresponding to an edge, column 2 line 15-34. Further Bachelder discloses where the method can use optional steps to identify and discard categorized boundary points that are out of line with similarly situated points. In addition, Bachelder also teaches any points lying more than a specified distance from the corresponding line are discarded, col. 9 line 51-63 and **48, 50.** Furthermore, the examiner takes the position that the object is spaced apart from the work surface to be that object edge is not in proximity of the other object edges. Since Bachelder discloses for a rectilinear object, for example, this includes a bounding box for each of the top, bottom, left, and right edges of the object. The boundary points are labeled to denote the respective edges which they belong based on (i) locations and orientations of those points, and (ii) locations of the plural bounding points, it is clear to the Examiner that Bachelder discloses determining the upper and lower edges of the object, which reads upon the claimed limitation).

Therefore, it would have been obvious to one of ordinary skill in the art to modify the apparatus of Kosuge (modified with AAPA, Buckley, and Well Known Prior Art) with the technique as disclosed in Bachelder in order to provide improved machine vision methods and, particularly, improved methods for determining characteristics of an object in an image.

Regarding **claim 6,** Kosuge (modified by Bachelder, AAPA, Buckley, and Well Known Prior Art), teaches everything as claimed above, see claim 5. Kosuge is silent in regards to wherein said first parameter comprises the value of an angle between an

angle reference axis and said notional reference line extending from the object respective edge data component.

However, Bachelder teaches wherein said first parameter comprises the value of an angle between an angle reference axis and said notional reference line extending from the object edge data component (Bachelder, col. 8 line 32-46 and fig. **3E** Bachelder discloses a method that categorizes boundary points of the object in the image as corresponding with edges of the real world object, or its model, if those points lie in the corresponding bounding boxes. In accord with steps **42, 46** the method identifies points as residing in bounding boxes and therefore corresponds to the appropriate edge).

Therefore, it would have been obvious to one of ordinary skill in the art to modify the apparatus of Kosuge (modified by AAPA, Buckley, and Well Known Prior Art) with the technique as disclosed in Bachelder in order to provide improved machine vision methods and, particularly, improved methods for determining characteristics of an object in an image.

Regarding **claim 7**, Kosuge (modified by Bachelder, AAPA, Buckley, and Well Known Prior Art), teaches everything as claimed above, see claim 5. Kosuge is silent in regards to wherein said second parameter comprises the value of an angle between the angle reference axis and said notional reference line extending between the respective object edge data component and said reference point.

However, Bachelder teaches said second parameter comprises the value of an angle between the angle reference axis and said notional reference line extending

between the respective object edge data component and said reference point (see analysis for claim 6. Furthermore, the method as disclosed by Bachelder includes to find points in respective bounding boxes, compare orientations of point with expected orientations and thus categorizing points as correlation with model or real-world object **42,44,46**).

Therefore, it would have been obvious to one of ordinary skill in the art to modify the apparatus of Kosuge (modified by AAPA ,Buckley, and Well Known Prior Art) with the technique as disclosed in Bachelder in order to provide improved machine vision methods and, particularly, improved methods for determining characteristics of an object in an image.

Regarding **claim 8**, Kosuge (modified by Bachelder, AAPA, Buckley, and Well Known Prior Art), teaches everything as claimed above, see claim 5. Kosuge is silent in regards to said reference point on the object plane comprises the position of the camera's focal point in the object plane and said notional reference line extending from the respective object edge data component comprises a line normal to the object at said object edge data component, and wherein said threshold value is 90 degrees.

However, Bachelder teaches said reference point on the object plane comprises the position of the camera's focal point in the object plane and said notional reference line extending from the respective object edge data component comprises a line normal to the object at said object edge data component, and wherein said threshold value is 90 degrees (see analysis for claims 6-7. Furthermore, the method as disclosed by Bachelder includes to estimate position, orientation and uncertainty of object in image

which includes where the points have a specified tolerance of the expected angular orientation of an edge, if so, the method categorizes the points as corresponding with the associated edge, col. 10 line 19-36 **36,42,44,46**).

Therefore, it would have been obvious to one of ordinary skill in the art to modify the apparatus of Kosuge (modified by AAPA, Buckley, and Well Know Prior Art) with the technique as disclosed in Bachelder in order to provide improved machine vision methods and, particularly, improved methods for determining characteristics of an object in an image.

Regarding **claim 9** Kosuge (modified by Bachelder, AAPA, Buckley, and Well Known Prior Art) as a whole teaches everything as claimed above, see claim 1. Kosuge is silent in regards to the processing apparatus is arranged to calculate a line of sight from the camera's focal point to the object edge data component and to determine the point at which the line of sight substantially meets the object edge, and to determine the amount of the offset depending on the location of said point.

However, Buckley teaches using a camera and a laser to determine surface measurements of the objects. The camera in conjunction with the laser intersects the object; the intersection points on the object are illuminated as a line and on the plate as a line. Each frame of the camera records the image of laser lines illuminating object as a set of three values; column value, row value and frame number. The set of values can be transformed or mapped into the (x, y, z) coordinate system to give the location of xyz points on the object surface with respect to the object reference system, col. 6 line 6-67 and col. 7 line 1-67 and col. 8 line 1-14).

Therefore, it would have been obvious to one of ordinary skill in the art to modify Kosuge (modified by Bachelder, AAPA, and Well Known Prior Art) with the technique as disclosed in Buckley in order to optimize the inspection process in order to increase the speed and improve the accuracy of the inspection.

Regarding **claim 10**, Kosuge (modified by Bachelder, AAPA, Buckley, and Well Known Prior Art) as a whole teaches everything as claimed above, see claim 9. Kosuge is silent in regards to wherein the line of sight lies in a plane substantially normal to the edge of the object at the location of the object edge data component.

However, Buckley teaches 3D imaging from edge points constructed from the column value, row value, and frame number of the pixel, col. 12 line 25-31, also see analysis made in claim 9).

Therefore, it would have been obvious to one of ordinary skill in the art to modify Kosuge (modified by Bachelder, AAPA, and Well Known Prior Art) with the technique as disclosed in Buckley in order to optimize the inspection process in order to increase the speed and improve the accuracy of the inspection.

Regarding **claim 11,** which recites a corresponding apparatus to the inspection system of claim 1 and 5. Thus, the analysis and rejection made in claim 1 and 5 also apply here because the inspection system in claim 1 and 5 would necessitate the need for an apparatus capable of providing the limitations of the apparatus in claim 11.

Regarding **claims 12-13,** which recite a corresponding method to the system for inspection of claim 1. Thus, the analysis and rejection made in claim 1 also apply here

because the inspection system in claim 1 would have necessarily performed the method steps in claim 12.

In further regards to **claim 13,** Kosuge (modified by Bachelder, AAPA, Buckley, and Well Known Prior Art), as a whole further teach a processor based system. Hence a computer program product comprising computer useable code for causing a computer to perform the method steps of the system of claim 1 would have been inherent.

Regarding **claim 14,** Kosuge (modified by Bachelder, AAPA, Buckley, and Well Known Prior Art) as a whole teaches everything as claimed above, see claim 1. Kosuge is silent in regards to a system as claimed in claim 1, wherein said object is substantially planar and has a substantially constant thickness, said processing apparatus being arranged to combine said object edge data components wit a data component representing said thickness in order to generate said three dimensional data representing said object.

However, Buckley teaches where wherein said object is substantially planar and has a substantially constant thickness (fig. 1 and fig. 5) , said processing apparatus being arranged to combine said object edge data components wit a data component representing said thickness in order to generate said three dimensional data representing said object (The preferred embodiment uses sensors that directly measure surfaces in three-dimensions, although the analysis methods described here also apply to diffuse light sources or edge-based measurement, (column 5 line 52-55). Further, disclosed is a method for determining the geometric model, described below is much simpler than determining a complete CAD-based geometric model. In a CAD-based

geometric model, every surface of the part must be included for a completed description, (column 29 line 3-6). Once the parameters (location, alignment and size) and thickness of a surface primitive are found from the scanned data, its extent can be determined. For example, a plane defined only by its parameter set p locates a plane of infinite extent. However, a real object 130 (FIG. 12) has surfaces that are limited, not infinite. Since the extents of a surface are often defined by other surfaces, the intersection of surfaces can define what portion of the primitive belongs to model 140 and which does not. Most surfaces, such as surface 132a, are limited by intersections with other surfaces. Edge 137a is the intersection of plane surface 132a and cylindrical surface 132b. Similarly, edge 137b forms the intersection between plane surfaces 137a and 132g limiting the extent of plane 132a (column 30 line 54-67). Therefore, it is clear to the examiner that Buckley includes the thickness and edge data to produce the 3D image since, Buckley discloses for a CAD-based geometric model, every surface of the part must be included for a completed description.

Therefore, it would have been obvious to one of ordinary skill in the art to modify Kosuge (modified by Bachelder ,AAPA, Buckley, and Well Known Prior Art) with the technique as disclosed in Buckley in order to optimize the inspection process in order to increase the speed and improve the accuracy of the inspection.

4. Claims 16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kosuge et al., US-6, 571, 196 in view of Bachelder et al., US-5, 974, 169 in view of Applicant Admitted Prior Art (AAPA), and in view of Buckley et al. US-6,064,759 in view

of Well Know Prior Art (Official Notice), and Further in view of Nishiwaki et al., US-2002/0172422 A1.

As to **claim 16**, Kosuge (modified by Bachelder, AAPA, Buckley, and Well Known Prior Art) as whole teaches everything as claimed above, see claim 5. Kosuge is silent in regards to a system as claimed in claim 5, wherein the processing apparatus is arranged to determine whether said object edge data points represent an interior perimeter of said object or an exterior perimeter of said object, and to arrange said object edge data points into sets in which each object edge data point in a respective set represents common interior or exterior perimeter, and where the processing apparatus determines whether at least one object edge data component in each set relates to a lower edge of the object or to an upper edge of the object.

However, Bachelder discloses where the processing apparatus determines whether at least one object edge data component relates to a lower edge of the object or to an upper edge of the object (column 2 line 15-24).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teachings of Bachelder with Kosuge (modified by AAP and Buckley) in order to provide improved machine vision methods and, particularly, improved methods for determining characteristics of an object in an image.

Kosuge (modified by Bachelder, AAPA, Buckley, and Well Known Prior Art) as whole is silent in regards to determine whether said object edge data points represent an interior perimeter of said object or an exterior perimeter of said object

However, Nishiwaki teaches determine whether said object edge data points represent an interior perimeter of said object or an exterior perimeter of said object ([0051]). Taking the teachings of Nishiwaki with Bachelder, now discloses to determine whether the upper or lower edges or interior edges.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teachings of Nishiwaki with Kosuge (modified by Bachelder, AAPA, and Buckley) for improved image processing. Taking the

Kosuge (modified by Bachelder, AAPA, Buckley, and Nishiwaki) as whole are silent in regards to arrange said object edge data points into sets in which each object edge data point in a respective set presents a common interior or exterior perimeter. However, Official Notice is taken that both the concept and benefit of providing the claimed limitations is notoriously well known and expected it the art, and therefore, would have been obvious to incorporate in Kosuge (modified by Bachelder, AAPA, Buckley, and Nishiwaki) for providing more efficient image measurement and analysis.

As to **claim 17,** see the rejection and analysis for claim 16, except this is a claim to an apparatus with the limitations of claim 16.

Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Contact

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JESSICA ROBERTS whose telephone number is (571)270-1821. The examiner can normally be reached on 7:30-5:00 EST Monday-Friday, Alt Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Marsha D. Banks-Harold can be reached on (571) 272-7905. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Marsha D. Banks-Harold/
Supervisory Patent Examiner, Art Unit 2621
/Jessica Roberts/
Examiner, Art Unit 2621